Portfolio

Wisconsin Cooperative Education Skill Certification
Electronics

Coop Areas Completed	Student Information
1. Core Employability Skills 2. DC Electronic Competencies 3. AC Electronic Competencies	

Student ______________________ **Phone** ______________

School ______________________ **Phone** ______________

Teacher Coordinator ______________________ **Phone** ______________

Workplace Mentor ______________________ **Phone** ______________

Other Information:

Start Date ______________________

End Date ______________________

Revised August 2002

Rating Scale

3 Proficient—able to perform entry-level skills independently.
2 Intermediate—has performed task; may need additional training or supervision.
1 Introductory—is familiar with process but is unable, or has not had the opportunity, to perform task; additional training is required.
SB School Based
WB Work Based

Description of Skills	Rating *3*	*2*	*1*	Initials *SB*	*WB*	*Comments*
PART ONE: Core Employability Competencies **20 competencies must be achieved at level 2 or 3**						
A. Demonstrates basic academic skills						
1. Reading-Locates, understands, and interpret written information in prose and in documents such as manuals, graphs, and schedules.						
2. Writing—communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs and flow charts.						
3. Mathematics—Performs basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques.						
4. Listening—Receives, attends to, interprets, and responds to verbal messages and other cues,						
5. Speaking—Organizes ideas and communicates orally.						
6. Career Development—Understands application process, develops personal career goals, understands individual potential.						
B. Personal/Interpersonal Skills: Displays responsibility, self-esteem, sociability, self-management, integrity and honesty, and extends these skills facilitating working						
7. Demonstrates integrity/honesty and chooses ethical courses of action.						
8. Serves clients/customers, working to satisfy customer's expectations.						
9. Participates as a member of a team, contributing to group efforts.						
10. Demonstrates leadership skills, including teaching other new skills.						
11. Works well with women and men from diverse backgrounds.						
C. Thinking/Information Processing Skills: Thinks relatively, makes decisions, solves problems, visualizes, knows how to learn and reason, and acquire and utilize information to aid these processes where necessary.						
12. Organizes, maintains, interprets, communicates information, using computers to aid this task where necessary.						
13. Recognizes problems and devises and implements plans of action.						
14. Generates new ideas through creative thinking.						

Description of Skills	Rating 3	2	1	Initials SB	WB	Comments
15. Makes decisions through specifying goals and constraints, generating alternatives, considering risks, and evaluating and choosing the best alternatives.						
16. Uses efficient learning techniques to acquire and apply new knowledge and skills.						
D. Systems/Technology: Understands complex interrelation ships of systems and works with a variety of technologies.						
17. Knows how social, organizational, and technological systems work and operates effectively with them.						
18. Understands relationships among technological functions, pinpoints errors in technologies' performance and corrects problems in operations.						
19. Selects the appropriate tools or equipment for a task, including computers and related technologies.						
20. Understand the function and proper procedures for technologies related to a task.						
21. Prevents, identifies, or solves problems with equipment, including computers and other technologies.						
22. Understands basic safety precautions and takes measures to implement them.						

PART TWO: DC Electronic Competencies

115 competencies must be achieved at level 2 or 3

A. Follow national, state, and local industry established safety procedures						
1. Learner familiarizes himself/herself with location of a first-aid kit in their working environment.						
2. Learner familiarizes himself/herself with location, access, and operation of area fire extinguishers.						
3. Learner familiarizes himself/herself with local access system for obtaining emergency help.						
4. Learner familiarizes himself/herself with posted warning signs and their connected procedure or process for full adherence.						
5. Learner uses OSHA certified: eye, hand, foot, and head protection in stipulated operations and locations.						
6. Learner recognizes sources of electrostatic build-up.						
B. Use established symbols, standards, conventions, and terminology.						
7. Learner matches the name for electrical and magnetic quantities and units, to the correct SI (International System of Units) symbol.						
8. Learner selects wire using the American Wire Gauge (AWG) standard.						
9. Learner matches engineering notation powers of ten, to the standard Metric prefix and symbol for each, used in electronics applications.						
10. Learner converts among metric prefixed units.						

Description of Skills	Rating 3	2	1	Initials SB	WB	Comments
11. Learner converts a quantity written in scientific notation to a standard metric prefix notation for electronics applications.						
12. Learner selects the correct electrical components from a schematic diagram for circuit assembly.						
13. Learner draws pathways on circuit diagrams displaying both conventional current and electron flow.						
14. Scientific calculator with industry standard measures is exploited for maximum mathematical efficiency.						
15. Reports are written expressing and analyzing quantitative results from lab exercises.						
C. Explain basic atomic theory as it applies to electronics						
16. Learner is able to draw a two dimensional atomic model, labeling all of its component parts.						
17. Learner lists the most common materials used as insulators and conductors.						
D. Explain the elements and properties of a basic electrical circuit.						
18. Learner gathers components for circuit assembly by interpreting schematic diagrams.						
19. Learner verifies circuit switching components are open prior to circuit assembly.						
20. Learner gathers and attaches instrumentation to measure voltage, current, and resistance of an open electrical circuit.						
21. Learner follows safety guidelines for attaching instrumentation to properly measure either: voltage, current, or resistance.						
22. Learner defines ground types when observing schematic diagrams.						
23. Learner follows safety guidelines when circuit is attached to a source.						
24. Learner measures voltage and current of a closed electrical circuit.						
25. Learner chooses correct circuit protection safety devices for installation from supplied information.						
26. Learner assembles basic circuit, and verifies operation according to supplied criteria.						
27. Learner explains the purpose of each of the four parts of a basic electrical circuit; source, load, complete path and control device.						
E. Describe DC voltage and the characteristics of DC voltage and current sources.						
28. Learner determines the internal resistance of primary cells, secondary cells, and electronic supply-voltage/current sources.						
29. Learner chooses the appropriate load to be attached to a voltage source to obtain maximum power transfer.						
30. Learner determines when a circuit load attached to voltage source maximizes efficiency or power transfer.						

Description of Skills	Rating 3	2	1	Initials SB	WB	Comments
31. Learner converts voltage source models to equivalent current source models.						
32. Learner converts current source models to equivalent voltage source models.						
33. Learner arranges cells/power supplies for a specified voltage/current.						
F. Describe electrical resistance, resistor types, and resistor characteristics.						
34. Learner chooses resistors from given values, tolerances, and reliability by reading the EIA color code bands.						
35. Learner identifies typical failures that occur with all types of resistors.						
36. Learner calculates conductance from values of resistance.						
37. Learner compares the resistance of incandescent lamps, when measured with an ohmmeter and sourced by their operating voltage.						
38. Resistors of fixed types are identified according to composition and value.						
39. Resistors of both fixed and variable types are identified according to power dissipation ability.						
40. Resistors of fixed types are verified against printed tolerance values.						
41. Resistors of all types are classified by positive, negative, or NPO, temperature coefficient.						
42. Conductors are measured for DC resistance.						
G. Measure electrical quantities						
43. Learner chooses appropriate instrumentation for measuring electrical quantities.						
44. Learner measures electrical quantities with both analog and digital multimeters.						
45. Learner interpolates meter movement pointer, positioned between scale tick marks for values of voltage, current and ohms.						
46. Learner selects appropriate resolving meter range with non-autoranging multimeter for voltage, current and ohmic values.						
47. Learner predicts when measuring instrumentation produces an unacceptable circuit loading effect.						
48. Learner measures DC/AC voltage quantities with an oscilloscope.						
49. Learner synchronizes various waveforms displayed on the oscilloscope using internal, external, and AC power line triggering sources.						
50. Learner measures phase difference between waveforms using an oscilloscope.						
51. Learner measures capacitor and inductor component values.						
52. Learner verifies AC frequencies with frequency counting instrumentation.						

Description of Skills	Rating 3	2	1	Initials SB	WB	Comments
53. Learner adjusts oscilloscope compensating probe.						
H. Analyze voltage, current, resistance and power relationships using Ohm's and Watt's Laws.						
54. Learner calculates to find each: voltage, current, or resistance, in a simple resistive circuit model.						
55. Learner calculates power dissipation in a simple resistive circuit model.						
56. Learner determines the efficiency for a system, given horsepower and input power.						
57. Learner measures values for voltage, current, resistance, and power to verify theoretical values.						
58. Circuits operate within specified tolerances.						
59. Circuits are analyzed for defects.						
I. Analyze Series and Parallel Circuits						
60. Learner reduces a series resistive circuit to an equivalent resistance.						
61. Learner reduces a parallel resistive circuit to an equivalent resistance and conductance.						
62. Learner calculates using Ohm's Law and Watt's Law, all electrical quantities for both series and parallel resistive circuits.						
63. Learner identifies a series electrical path.						
64. Learner identifies parallel electrical paths.						
65. Learner calculates voltage drops, using Kirchhoff's Voltage Law and the voltage divider rule, for all resistive values in open and closed series resistive circuits.						
66. Learner designs a working voltage divider from supplied technical guidelines.						
67. Learner measures values in voltage dividers to verify theoretical values.						
68. Learner calculates branch currents, using Kirchhoff's Current Law and the current divider rule, for all resistive branches in open and closed parallel resistive circuits.						
69. Learner measures values in current dividers to verify theoretical values.						
70. Series and parallel circuits operate to specified tolerances.						
71. Series and parallel circuits will be analyzed for defects.						
J. Analyze Combination Series and Parallel Circuits.						
72. Learner distinguishes between a series current path and a parallel current path.						
73. Learner reduces a combinatorial series - parallel resistive circuit to an equivalent resistance.						
74. Learner calculates, using Ohm's Watt's, and Kirchhoff's Laws, all electrical quantities throughout combinatorial series - parallel resistive circuits.						

Description of Skills	Rating 3	2	1	Initials SB	WB	Comments
75. Learner calculates changes in a voltage divider circuit, when loaded.						
76. Learner predicts changes in a circuit, when test equipment is placed in a circuit.						
77. Learner determines an unknown resistor value to balance a Wheatstone bridge.						
78. Learner lists applications for the Wheatstone bridge.						
79. Learner measures values in combinatorial series - parallel circuits to verify theoretical values.						
80. Combinatorial series - parallel circuits operate to specified tolerances.						
81. Combinatorial series - parallel circuits will be analyzed for defects.						
K. Apply Network Analysis Techniques to Complex Linear DC Resistive Circuits.						
82. Learner identifies nodes and branches in complex resistive circuits.						
83. Learner draws the current loops indicating polarities for complex resistive circuits.						
84. Learner applies the superposition theorem to analyze complex resistive circuits with two voltage sources.						
85. Learner simplifies complex single voltage sourced resistive circuits using Thevenin's Theorem.						
86. Learner simplifies complex single current sourced resistive circuits using Norton's Theorem.						
L. Apply Network Analysis Techniques to Complex Linear DC Resistive Circuits.						
87. Learner draws symbolic magnetic flux lines around a permanent bar magnet indicating flux line polarity and pole location.						
88. Learner selects, from pictorial examples, magnetic attraction versus magnet repulsion.						
89. Learner lists common diamagnetic materials and paramagnetic materials.						
90. Learner draws a pictorial model of magnetic flux lines around a current carrying conductor observing flux line and current direction.						
91. Learner demonstrates the left and right hand rules for conductors and coils.						
92. Solenoid circuit is assembled and tested.						
93. Relay circuit is assembled.						
94. Relay is classified for electoral parameters and contact forms.						
95. Relay is tested for pull-in and hold currents.						
96. d'Arsonval meter operation is observed.						
97. Learner observes the laws of Faraday and Lenz.						
M. Analyze Capacitance and Capacitors in DC Circuits.						

	Rating			Initials		
Description of Skills	***3***	***2***	***1***	***SB***	***WB***	***Comments***
98. Learner calculates quantity of change for a capacitor for a given terminal voltage.						
99. Learner describes plate area and separation as they relate to capacitance.						
100. Learner describes the change in capacitance caused by a change in relative permittivity (dielectric constant).						
101. Learner defines dielectric strength as it relates to capacitors.						
102. Learner describes the construction of an electrolytic capacitor and the reasons for maintaining polarity.						
103. Learner lists common failures in capacitors based on type and style.						
104. Capacitors are measured for their leakage and equivalent series resistance (ESR).						
105. Capacitors are measured for comparison to their tolerance standards.						
106. Electrolytic capacitors are connected for use in non-polarized circuits.						
107. Capacitors are arranged in combinatorial series and parallel configurations to measure total capacitance and compare with calculated values.						
108. Learner constructs and tests a capacitive voltage divider.						
109. Capacitive circuits operate to specified tolerances.						
110. Capacitive circuits will be analyzed for defects.						
111. Learner plots charging and discharging phases for five time constants of a simple DC sourced resistor - capacitor network comparing results to the calculated analysis.						
112. Learner explains the DC blocking ability of a capacitor.						
113. Learner describes the initial instantaneous condition for the application of DC to a discharged capacitor, correlating the condition to a fully charged capacitor.						
N. Analyze Inductance and Inductors in DC Circuits.						
114. Learner explains inductance.						
115. Learner relates the principles for electromagnetism to inductors.						
116. Learner draws a pictorial model of magnetic flux lines around a current carrying inductor, observing pole position, along with flux line and current direction.						
117. Learner explains the principles of Faraday’s and Lenz’s Law for inductors.						
118. Learner describes changes in inductance when core permeability changes.						
119. Learner adjusts ferrite core inductors for minimum and maximum inductance.						

Description of Skills	Rating 3	2	1	Initials SB	WB	Comments
120. Learner calculates total inductive values in combinatorial and mutually coupled series and parallel inductors.						
121. Learner chooses inductors from given values by reading the EIA color code bands, then verifies and checks tolerances.						
122. Inductors made of both large and small gauge conductors and varying inductance values, are measured and compared for DC resistance.						
123. Learner constructs and tests an inductive voltage divider.						
124. Inductive circuits operate to specified tolerances.						
125. Inductive circuits will be analyzed for defects.						
126. Learner explains when inductor DC resistance values become a concern.						
127. Learner plots charging and discharging phases for five time constants for a simple DC sourced resistor - inductor network comparing results to the calculated analysis.						
128. Learner describes the initial instantaneous condition for the application of DC to a resistor - inductor circuit model, then compares this condition to the circuit after five time constants.						

PART THREE: AC Electronic Competencies

(A score of 150 or greater is required to pass this section. No more than 8 may be achieved at the "1" level.)

O. Describe AC Voltage and the Characteristics of AC Voltage Sources.						
1. Learner lists sources of AC generation						
2. Learner explains the difference between an AC sinusoid and an equivalent steady state DC source for a period of time.						
3. Learner converts a sinusoid period to its equivalent frequency.						
4. Learner converts the frequency of a sinusoid to its equivalent period.						
5. Learner labels a sine wave at its peak amplitude and zero crossing for one cycle, with the related degree and radian representations.						
6. Learner calculates a sinusoid frequency in radians.						
7. Learner calculates peak and rms values from sine wave peak-to-peak values.						
8. Learner calculates peak-to-peak values from peak and rms values for sine waves.						
9. Learner calculates the average value for a half-cycle sine wave.						
10. Learner calculates average values of DC offset sine waves.						
11. Learner calculates the phase shift, in degrees, of two coherent sinusoids, stating which is leading or lagging.						
12. Learner calculates using Ohm's, Watt's, and Kirchhoff's Laws, all electrical quantities in AC sourced combinatorial series - parallel complex resistive circuits.						

Description of Skills	Rating 3	2	1	Initials SB	WB	Comments
13. Learner determines the effective value of an AC source is providing the same energy as its equivalent DC source.						
14. AC voltmeter is used to measure values for combinatorial series - parallel resistive circuits to verify theoretical values.						
15. Oscilloscope is used to measure values for combinatorial series - parallel resistive circuits to verify theoretical values.						
16. Learner relates measurements between an AC voltmeter and an oscilloscope.						
17. Frequency counter is used to measure and compare oscilloscope determined frequencies from a variable frequency voltage source.						
18. AC circuits operate to specified tolerances.						
19. AC circuits will be analyzed for defects.						
P. Describe Types of Transformers and the Principles of Their Operation.						
20. Learner explains mutual inductance.						
21. Learner explains the coefficient of coupling for values less than one.						
22. Learner calculates mutual inductance for various coefficients of coupling.						
23. Learner calculates transformer turns ratio to determine if it is step-up or step-down.						
24. Learner calculates primary or secondary transformer voltages from the transformation ratio and either the primary or secondary voltage.						
25. Learner contrasts transformer core materials as it relates to operating frequencies.						
26. Learner defines core losses in transformers and describes the methods used to reduce the losses.						
27. Learner calculates transformer impedance ratio from the turns ratio.						
28. Learner calculates transformer turns ratio from the impedance ratio.						
29. Learner calculates the primary and secondary currents for resistor loaded transformer circuits.						
30. Learner lists common failures in transformers based on type and operation.						
31. Transformers are tested for primary to secondary DC isolation.						
32. Transformer primary and secondary winding resistances are measured.						
33. Transformer physical polarity markings are verified for accuracy.						
34. Transformers with tapped primaries and secondaries are wired for various voltages.						

Description of Skills	Rating 3	2	1	Initials SB	WB	Comments
35. Transformers are used to isolate circuits from the AC power line.						
Q. Analyze AC Circuits Containing Reactive Components.						
36. Learner calculates and plots capacitive reactance for a range of frequencies.						
37. Learner calculates and plots inductive reactance’s for a range of frequencies.						
38. Learner determines that current leads voltage for a capacitor.						
39. Learner determines that current lags voltage for an inductor.						
40. Learner graphically expresses the impedance for simple RC and RL series circuits.						
41. Learner calculates impedance for simple RC and RL series circuits using the Pythagorean Theorem.						
42. Learner calculates impedance and phase for simple RC and RL series circuits, expressed in both polar and rectangular form.						
43. Learner calculates, using Ohm’s Law, both voltage and current for simple RC and RL series circuits.						
44. Learner applies the voltage divider rule to simple RC and RL series circuits.						
45. Learner calculates impedance for simple RC and RL parallel circuits using the Pythagorean Theorem for current and Ohm’s Law to solve for impedance.						
46. Learner calculates impedance and phase, using admittance, conductance, and susceptance, for simple RC and RL parallel circuits, expressed in both polar and rectangular form.						
47. Learner calculates branch currents for simple RC and RL parallel circuits using the current divider rule.						
48. Learner graphically expresses (power triangle) the relationship of true and reactive power to apparent power.						
49. Learner calculates power factor, then determines the corrective action when required.						
50. Learner calculates total impedance for combinatorial series - parallel RC circuits.						
51. Learner calculates total impedance for combinatorial series - parallel RL circuits.						
52. Learner calculates impedance and phase for simple RLC series circuits, expressed in both polar and rectangular form.						
53. Learner calculates impedance and phase for simple RLC parallel circuits, expressed in both polar and rectangular form.						

Description of Skills	Rating 3	2	1	Initials SB	WB	Comments
54. Oscilloscope is used to measure voltages in series, parallel, and combinative reactive circuits to verify theoretical values.						
55. Oscilloscope is used to verify RC and RL circuits as lead/lag phase shift networks.						
56. Frequency response curves are plotted for RC and RL lead/lag networks.						
57. Reactive circuits for RC and RL lead/lag networks are calculated for critical frequency.						
58. Reactive circuits operate to specified tolerances.						
59. Reactive circuits will be analyzed for defects.						
R. Analyze Resonant Circuits.						
60. Learner defines the electrical condition when inductive and capacitive reactances are equal.						
61. Learner derives the resonant frequency formula from reactance formulae.						
62. Learner calculates resonant frequencies for both series and parallel resonant circuits.						
63. Learner identifies frequency response curves for band-pass and band-reject (stop) characteristics for series and parallel resonant circuits.						
64. Learner explains the fly-wheel effect.						
65. Learner explains Q for inductors and DF (dissipation factor) for capacitors and the effect they have on resonant frequency and bandwidth for series and parallel resonant circuits.						
66. Learner calculates circuit Q for both series and parallel resonance, unloaded and loaded.						
67. Learner defines the “skin effect” for inductors and its relation to circuit Q.						
68. Learner calculates bandwidth based on circuit Q.						
69. Learner calculates the change of resonant frequency, with a change of Q for a parallel resonant circuit.						
70. Learner measures and plots frequency response characteristics of resonant circuits.						
71. Resonant circuit characteristics: of voltage, current, and phase, are determined; below, at, and above resonance.						
72. Resonant circuits are measured, analyzed and compared to theoretical analyses, for resonant frequency, bandwidth, and circuit Q.						
73. Resonant circuits operate to specified tolerances.						
74. Resonant circuits will be analyzed for defects.						

The Competencies in This Portfolio Have Been Endorsed By:

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Technology Education
Association

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